



Review

A review of the management of small bowel obstruction

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Small bowel obstruction is a significant surgical problem and is commonly caused by postoperative adhesions. Patients suffering from this condition are often difficult to assess and require careful evaluation and management.

Articles regarding the diagnosis, evaluation and management of small bowel obstruction have been identified from the Ovid, Embase and Silver Platter electronic databases and then reviewed by the authors. Particular emphasis has been placed on randomised controlled trials or large prospective series. Anecdotal reports or those containing small numbers have been largely excluded, but where they have been included it has been made clear in the text.

The management of small bowel obstruction is predominantly the management of obstruction due to postoperative adhesions. The selective use of radiological techniques, such as water soluble contrast and CT studies, often help to characterise the nature of the obstruction and may even help with its resolution. Techniques involving the use of laparoscopy and barrier membranes may reduce morbidity but there is a need to evaluate these strategies further with prospective clinical trials.

Key words: Small bowel obstruction – Postoperative adhesions – Management – Review

Small bowel obstruction is a frequently encountered problem in general surgery and is associated with considerable morbidity and mortality. The most common cause of small bowel obstruction is postoperative

adhesion formation. It has been estimated that up to 70% of cases of small bowel obstruction in the US are due to adhesions.¹ Intra-abdominal adhesions are occasionally congenital or inflammatory, but the great majority

result from previous surgery. In a prospective analysis of 210 patients undergoing laparotomy who had previously had one or more abdominal operations, 195 (93%) were found to have adhesions attributable to their prior surgery.²

The Surgical and Clinical Adhesions Research Study (SCAR) has recently reported its preliminary findings.³ SCAR is a large scale epidemiological study performed with the Scottish Medical Record Linkage Database which has prospectively followed a cohort of 52,192 patients undergoing a laparotomy in Scotland in 1986. It reports a 1 in 3 risk of re-admission with a possible adhesion-related problem over the subsequent 10 years; a 5% rate of a definite adhesion-related admission (2002 patients). This study suggests that the burden of adhesion-related disease continues to increase for at least 10 years after the index operation and probably beyond. SCAR has also reported on the potential economic implications of postoperative adhesions. The cost of treating 2000 patients with definite adhesion-related problems over 10 years has been calculated to be over £4.5 million. The 1994 prevalence figures for adhesion related disease suggest a cost of over £6 million which would equate to a figure 10 times larger if the entire UK population was taken into consideration.

Once small bowel obstruction is clinically apparent it is vital, but often difficult, to be able to diagnose its cause accurately. If bowel ischaemia is evident, urgent operative treatment is clearly indicated. The pattern of this problem is unpredictable. A recent study has demonstrated that any patient re-admitted for adhesion-related problems is as likely to require non-operative treatment as opposed to surgery and that subsequent admissions are equally likely to require non-operative or operative treatment, irrespective of the previous treatment received.⁴ This suggests that it is not possible to predict the type of treatment any particular patient may require in the future.

The purpose of this review is to attempt to address the controversies surrounding the management of small bowel obstruction with particular emphasis placed on obstruction due to postoperative adhesions.

Aetiology

The commonest cause of small bowel obstruction is post-operative adhesion formation followed by obstruction as a complication of herniae and that secondary to malignancy (both primary and secondary). Other less common causes are obstruction due to congenital bands, inflammation, radiation, bezoars, intussusception and

volvulus. Mucha's review of the Mayo Clinic experience demonstrated that adhesions caused 49% of 319 surgically managed small bowel obstructions,⁵ which is a similar rate to that reported by Ellis,⁶ but lower than the 79% adhesion rate reported by Cox *et al.*⁷

All individuals who have had an operation in which the peritoneal cavity has been entered have a subsequent life-time risk of obstruction secondary to adhesions. There is a high rate of adhesion formation postoperatively, but only a relatively small number of patients will go on to have complications related to the adhesions. The overall rate of adhesion related morbidity is at least 3–5% of all laparotomies.^{2–4} Certain procedures are more likely to cause obstruction than others. Cox *et al.* showed that appendicectomies and colorectal resections were responsible for 43% of cases.⁷ Appendectomy has been shown to have an 11% rate of small bowel obstruction due to adhesions over a 64 month period, compared with a rate of 5% following open cholecystectomy over a similar period.⁸ Fazio and his colleagues at the Cleveland clinic reported that of 1005 patients undergoing total colectomy and ileo-anal pouch reconstructions, no less than 7.5% developed adhesive obstruction in the early postoperative period and a further 17.8% were similarly affected at a later stage.⁹

Diagnosis

The main diagnostic challenges posed by small bowel obstruction are: (i) to establish the underlying cause; (ii) the identification of strangulation; and (iii) to determine which patients can be managed non-operatively. The management of this condition requires accurate history taking and repeated examination until resolution. In situations where doubt about a case exists, there is no substitute for repeated clinical examination by an experienced surgeon.

History and examination

The majority of patients with small bowel obstruction will give a history of previous abdominal surgery or an irreducible hernia will be evident. If these factors are not present in a patient with small bowel obstruction, a laparotomy is necessary. Abdominal pain, nausea and vomiting, constipation and abdominal distension are usually present. The pain is initially intermittent and colicky in nature. Bowel sounds are often high pitched, increasing with the onset of cramping pain. Visible peristalsis or 'laddering' of the small bowel may be visible in thin patients. The presence of severe or

worsening pain with associated tenderness, peritonism and toxicity are clear indications of bowel ischaemia. Once resuscitated, these patients should undergo a laparotomy as a matter of urgency.

A randomised controlled trial of over 1300 patients with acute abdominal pain in Finland indicated that the presence of previous surgery (relative risk (RR) 12.1) and the type of pain (colicky versus constant, RR risk 2.4) were the most accurate predictive symptoms in the diagnosis of acute small bowel obstruction. The most accurate clinical signs were abdominal distension (yes versus no, RR 13.1) and bowel sounds (normal versus abnormal, RR 9). In this study, the diagnosis made clinically had a sensitivity of 75% and a specificity of 99%. By comparison, the computer based diagnostic score had a greater sensitivity of 87% and a similar specificity.¹⁰ Computer assistance in the diagnosis of strangulation has been reported to increase the accuracy of detecting the presence of viable 'strangulation' (*i.e.* reversible ischaemia) from 66% to 82% and those with non-viable, irreversible ischaemic strangulation from 46% to 97%.¹¹

Patients with a history of malignancy

A past history of malignancy should not be a deterrent to aggressive management as a significant number of patients will have a non-malignant cause of their obstruction. Walsh and Schofield described 17 out of 53 (32%) patients with previous intra-abdominal malignancy presenting with small bowel obstruction not due to malignancy.¹² Similarly, Ellis *et al.* found 30% of individuals with known recurrence of colorectal cancer presenting with small bowel obstruction to have adhesions as the cause for their obstruction.¹³ The percentage went up to 82% in patients with no pre-operative evidence of colorectal cancer recurrence. However, it is clear that obstruction which is secondary to recurrent malignancy does have a poor outlook.¹⁴ The overall mortality rate associated with surgery for acute bowel obstruction secondary to malignancy is about 20%.¹⁵ This rate increases when the surgery is palliative (23%) and particularly if the patient is malnourished (73%).¹⁶ Age *per se* is no barrier to surgery; aggressive treatment in patients over 70 years of age has been reported to reduce the risk of complications;¹⁷ but, in patients with intra-abdominal cancer the operative mortality rate increases from 18% in patients under 50 years to 69% in those over 70 years.¹⁸

If it is clear from the outset that the patient is too unwell for surgery, intravenous fluids and nasogastric suction should not be commenced as there is no evidence that this leads to sustained relief.¹⁹ Drugs

given subcutaneously will often provide good relief of pain and colic, but this type of management requires close co-operation between the surgical and palliative care teams.²⁰

Laboratory investigations

There are no diagnostic laboratory tests that will accurately confirm or refute the diagnosis of small bowel ischaemia. The white blood cell count may be normal or slightly elevated in uncomplicated small bowel obstruction, but high counts ($>15.0 \times 10^9/l$) or very low counts ($<4.0 \times 10^9/l$) are suspicious and should alert the clinician to the possibility of bowel ischaemia. The haematocrit and serum urea will be elevated in individuals suffering from dehydration. Serum electrolytes will often remain normal in distal small bowel obstruction. A proximal obstruction will create a pattern of metabolic alkalosis with hypokalaemia and hypochloraemia, similar to that seen in gastric outlet obstruction. A raised serum amylase is unusual in small bowel obstruction and is more suggestive of pancreatitis. Serum phosphate, creatine kinase and glutamate oxalotransferase (SGOT) have been suggested as possible markers of complicated small bowel obstruction, but have not been of proven help.¹

Radiology

Plain films

The use of radiology can be central to the correct diagnosis of small bowel obstruction. Plain supine abdominal films will often give sufficient information in the form of distended small bowel loops and an absence of colonic gas. A 'normal' plain abdominal X-ray does not, however, exclude the presence of small bowel obstruction. Traditionally, an erect or right lateral decubitus film was performed in order to demonstrate 'fluid levels', free gas within the peritoneal cavity (suggesting perforation) or within the biliary tree (gallstone ileus). There has been a suggestion that the erect film should not be used routinely as it does not increase diagnostic accuracy.²¹ The Royal College of Radiologists states in its guidelines that erect abdominal films add nothing to the information available in a supine film.²² However, the presence of fluid levels or free intra-peritoneal gas not obvious on a supine film may help members of the surgical team to be alerted to a potential problem. Particularly if no senior radiologist is at hand to report a supine film accurately or in the management of a difficult case. An erect chest X-ray can give further information by

demonstrating free intra-peritoneal gas under the domes of the diaphragm and air-fluid levels in the upper abdomen.

Small bowel contrast studies

Small bowel contrast studies can be performed with relative ease in patients where the diagnosis of partial or complete small bowel obstruction is being considered. This examination entails the ingestion of 100 ml of a water soluble contrast medium (such as Gastromiro) or its instillation via a nasogastric tube with a supine abdominal film performed after 4 h.²³ This procedure has been reported to be safe,²³⁻²⁵ more accurate in the correct diagnosis of small bowel obstruction than plain abdominal X-rays²⁶ and highly predictive of outcome with a 4 h cut-off point.²⁷ A recent report describes a similar technique where 40 ml of urografin diluted with 40 ml of water was used with a 24 h cut-off point.²⁸ This prospective study on 112 patients noted a specificity of 100% and a sensitivity of 98%. Dixon *et al.* performed a 10 year review of their experience with small bowel enemas in 1465 patients and reported a sensitivity of 93.1% and a specificity of 96.9%.²⁹ In contrast, Cheadle *et al.* found that the technique was not of help; however, this particular study used barium as a contrast medium and led to a barium peritonitis in 2 cases.³⁰ The potential therapeutic value of such an examination will be discussed in the next section.

CT and ultrasound scanning

Other radiological modalities which have been reported to be useful in the management of small bowel obstruction include CT and ultrasound scanning. In comparing CT scanning with plain abdominal X-rays, Maglinte *et al.* reported superior specificity with CT (79% versus 57%) but similar rates of sensitivity and accuracy.³¹ Most reports on the use of CT in small bowel obstruction note that its superiority lies in its ability to establish the cause of non-adhesive obstruction, in particular where the obstruction is secondary to a neoplastic process.³¹⁻³⁶

A recent report has suggested that CT scanning is highly specific in the identification of strangulation in adhesional small bowel obstruction with the identification of reduced mural enhancement, ascites and mesenteric congestion; however, these signs are not very sensitive.³⁷ Ultrasound has been reported to be more accurate than plain abdominal radiography,^{38,39} and better at diagnosing the level of obstruction³⁸ and the presence of strangulation.⁴⁰ There are no published randomised controlled trials comparing any of these techniques with plain abdominal radiography.

In our opinion, both erect and supine abdominal films are of help to the clinician in the assessment of small bowel obstruction. Similarly, water soluble contrast studies, which are known to be useful and easily performed, should be used in all but the most rapidly resolving cases in order to achieve an accurate diagnosis and possibly to help with treatment (see treatment section). CT scanning should be reserved for complex cases, particularly where the cause of small bowel obstruction may not be adhesion related.

Treatment

This section will deal solely with the treatment of patients with obstruction which is considered to be caused by adhesions. If there is evidence of bowel ischaemia or peritonitis, surgery should be performed as soon as the patient has been resuscitated. There is general agreement that it is safe to manage the remainder of cases non-operatively, at least initially, as a significant number of patients with obstruction due to adhesions will settle,⁴¹⁻⁴⁵ with fewer complications and a shorter hospital stay.^{4,46} Most conservatively treated patients resolve within 48 h.^{44,45}

Contrast studies

There is conflicting evidence from two randomised controlled trials investigating the usefulness of a hypertonic water soluble contrast medium (as described above) helping to resolve a partial obstruction. The study by Assalia *et al.* in 99 patients indicated that an oral gastrograffin examination was safe and shortened the length of stay in the treated patients.⁴⁷ Feigin *et al.* agreed that the test was safe but saw no therapeutic benefit over and above usual conservative management.⁴⁸

Intestinal tubes

As part of routine management, the use of a nasogastric tube is well established in order to deflate the stomach and proximal small bowel. There are some reports of the use of longer intestinal tubes placed either endoscopically or with radiological guidance.⁴⁹⁻⁵³ No advantage from the use of long tubes over standard length nasogastric tubes was shown in a randomised controlled trial performed by Fleshner *et al.*⁵⁴

Early postoperative obstruction

Patients developing signs and symptoms of small bowel obstruction shortly after a laparotomy behave in

a different manner to those who develop obstruction at a time distant from their last operation. Bowel ischaemia is uncommon and the obstruction will reportedly resolve in 80–90% of patients within 14 days, provided that the patient has nasogastric suction and is parenterally nourished and hydrated.⁵⁵ The main reported exception to this is in patients who have undergone abdomino-perineal resection. Immediate intervention has been recommended in these patients with early obstruction. Adhesions and defects of the pelvic floor were the two most common aetiological factors described in this group.⁵⁶

Multiple episodes of small bowel obstruction

Patients who suffer multiple episodes of small bowel obstruction represent a major therapeutic challenge. There is an understandable reluctance to operate on a patient who has had multiple abdominal procedures, particularly if some of these had been performed for previous episodes of adhesive obstruction. Little is known of the recurrence rate and severity of repeated episodes of adhesive small bowel obstruction. It has been suggested that 15–30% of patients with adhesive small bowel obstruction will develop a further episode in the future.^{57–59} Provided there are no clear indications of peritonitis or ischaemia, a course of non-operative therapy is indicated.⁶⁰ In those who fail to settle or in those with clinical evidence suggestive of ischaemic bowel, great care has to be taken in entering the abdomen and in dividing all adhesions involving the small bowel from the duodeno-jejunal flexure onwards. This necessitates careful dissection in order to minimise the risk of creating serosal or full thickness tears. Prevention of further adhesive obstruction by plicating the small bowel or placing long intestinal tubes to allow the adhesions to form in a predictable manner are techniques which appear to perform well in the hands of enthusiasts but which require considerable time and experience.^{61,62} There have been no randomised controlled trials to support or refute their use.

Laparoscopic surgery

There is increasing evidence that laparoscopic techniques are an effective way of treating adhesions and may reduce the rate of further adhesion related problems.^{63–67} A recent report has indicated that a number of patients with adhesive small bowel obstruction can be managed satisfactorily laparoscopically, with some of these patients leaving hospital within 72 h; however, in this study 7 of the 80 laparoscopically

treated patients required a further operation within 21 days.⁶⁷

Reduction of adhesion formation

Other ways of attempting to reduce adhesion reformation have been investigated with varying degrees of success.

Fibrinolytic agents act to reduce adhesion formation directly by reducing the fibrinous mass by stimulating plasminogen activator activity. These agents appear to function in rabbit models but human studies have yet to be reported.^{68,69} Anti-inflammatory agents have been used in laboratory studies in order to reduce vascular permeability and histamine release and stabilise lysosomes but these observations have been limited to animals.^{70,71}

Techniques causing physical separation of tissues have shown the greatest promise. These include the use of high viscosity solutions such as dextran 70. This has been shown to reduce the formation of pelvic adhesions in a prospective randomized double blinded multicentre trial.⁷⁰ Unfortunately, these solutions cause an unacceptable degree of side-effects which include anaphylaxis and osmotically driven fluid shifts.⁷¹

The introduction of sheets of material to form separating barriers in the form of polytetrafluoroethylene (Goretex) membranes^{72,73} or combinations of hyaluronidase with methylcellulose (Seprafilm/Sepracoat)^{74,75} have been shown to reduce adhesion formation between the parietal and visceral peritoneum in human studies. Goretex based products have the disadvantages of not being bio-resorbable and usually require suturing into position. The converse is true with Seprafilm/Sepracoat and two separate clinical randomised controlled trials have demonstrated a reduction in the degree of adhesion formation after placement of Seprafilm.^{74,75}

The multi-centred study of Becker *et al.*⁷⁴ studied 183 patients from 11 centres. All of the patients underwent colectomy and ileo-anal J pouch temporarily defunctioned with a loop ileostomy. The subjects were randomised to receive or not to receive Seprafilm which was placed under the abdominal incision. The density of adhesions were then assessed laparoscopically at the time of closure of the stoma through the trephine site once the stoma had been mobilised and the bowel re-anastomosed. There was a significant reduction of adhesion formation in those patients treated with Seprafilm.

A similar randomised controlled study was performed in 127 patients undergoing myomectomy where a second look laparoscopy assessed the incidence and

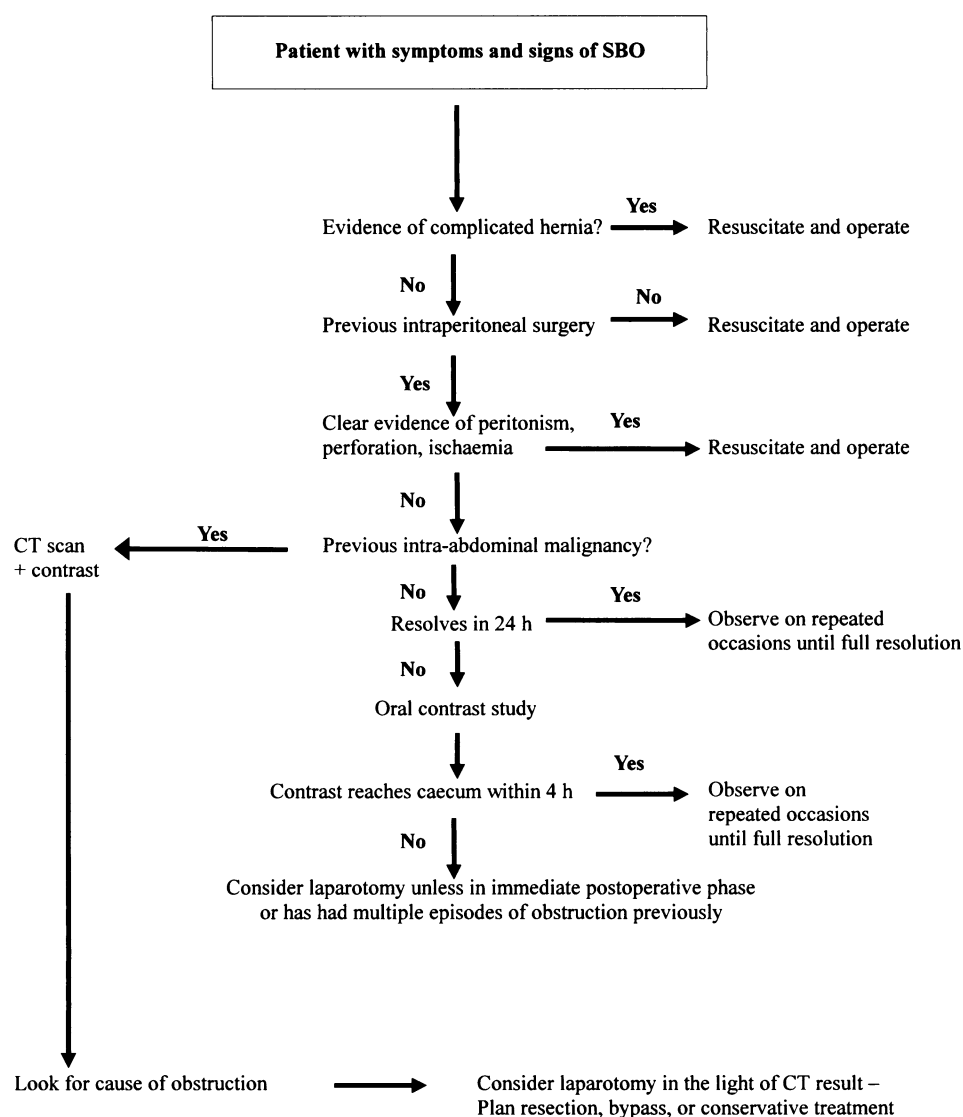


Figure 1 Suggested algorithm for the management of small bowel obstruction (SBO)

severity of uterine adhesions.⁷⁵ Again, in patients treated with Seprafilm there was a statistically significant reduction of adhesion formation.

These studies indicate that a hyaluronidase membrane reduces the formation of adhesions at the sites where it is placed without an increase in complications. It is not yet clear if these products will reduce the number of symptomatic adhesions or episodes of small bowel obstruction. It would seem likely that there is a need to apply this type of substance throughout the peritoneal cavity in order to reduce all adhesion formation. A randomised controlled trial is required in order to assess the potential benefit of this type of treatment.

The evidence presented in this review is summarised in the algorithm (Fig. 1) which attempts to give a suggested management strategy for patients with small bowel obstruction.

Conclusions

The management of small bowel obstruction is predominantly the management of obstruction related to the formation of postoperative adhesions. Evidence from the SCAR study indicates that adhesion related problems represent a significant burden of disease for the individual patient and the health service. Some of

the most difficult decisions in general surgery revolve around the assessment and management of obstruction caused by adhesions.

In patients with small bowel obstruction who have not had previous abdominal surgery, or in those with clinical evidence of bowel ischaemia, a laparotomy is mandatory. This should be performed as soon as possible. In all other cases of small bowel obstruction, there is still no substitute for repeated, experienced assessment of a patient in conjunction with plain and contrast radiology. Water soluble contrast studies of the small bowel are simple and effective. This technique increases the accuracy of diagnosis and potentially helps to resolve an episode of obstruction. CT scanning is particularly helpful in the assessment of patients with previously diagnosed intra-abdominal malignancy and in those patients where the obstruction is not adhesional in origin.

The operative management of small bowel obstruction continues to require safe and complete division of adhesions without creating unnecessary enterotomies. Laparoscopic techniques may become a useful adjunct to the treatment of the patient with small bowel obstruction but it is clearly not suitable for widespread use and requires further evaluation. The use of intra-peritoneal barriers show promise in reducing adhesion formation where they are applied. The challenge here will be to provide effective adhesion prophylaxis throughout the peritoneal cavity in order to prevent all symptomatic adhesions. There is a need for long-term clinical trials to demonstrate this reduction.

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